

Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1 (currently amended): A method for storing data on a storage ~~media~~ medium ~~comprising a magnetic disk~~, the method comprising:

writing the data to the storage ~~media in a density sufficiently high medium in which the spacing between adjacent magnetized locations of the magnetic disk is smaller than 50nm whereby the data for a recording density is written at greater than 500 kFCI (19685 kFCm)~~ so as to cause spontaneous degradation of the data over time;

automatically reading the data ~~prior to occurrence of a hard error periodically; generating a refresh indicator value and checking if the refresh indicator satisfies a predetermined condition related to degradation of the data over time;~~ and

writing the data a second time only if said predetermined condition is satisfied.

Claims 2-32 (canceled).

33 (new): A method according to claim 1, further comprising:

writing the data to the storage medium with a grain diameter below 100 Å.

34 (new): A method according to claim 1, further comprising writing the data to the storage medium with an energy ratio below 50 KuV/KBT at room temperature.

35 (new): A method according to any one of claims 1, 33 and 34 comprising estimating an expected time to occurrence of a hard error by any one or more of the steps of (a) checking if the readback signal has fallen to at least 88% of its original amplitude, (b) empirically determining the duration of operation without errors on a test disk, and using this error free duration to generate and store a refresh date, (c) determining the occurrence of a predetermined number of soft errors.

36 (new): A method according to any one of claims 1, 33 and 34, the method further comprising:

writing the data to the magnetic disk, at least a portion of the data being written to a group of grains in a track at a density sufficiently high to cause a change in direction of magnetization of at least some of the grains with passage of time; and

automatically refreshing at least the portion of data, using the refresh indicator.

37 (new): A method according to claim 36 comprising automatically refreshing at least the portion of data, using at least two refresh indicators.

38 (new): The method of any one of claims 1, 33 and 34 further comprising writing the refresh indicator to a location in the storage medium distinct from another location used to write data.

39 (new): The method of claim 38 further comprising using a date of performance of said “writing the data to the storage medium” to determine the refresh indicator.

40 (new): The method of claim 39 wherein:
said using includes setting the refresh indicator to be said date; and
said predetermined condition is satisfied when said refresh indicator is older than a current date by a predetermined time period.

41(new): The method of claim 39 wherein:
said determining includes setting the refresh indicator to be a refresh date obtained by adding a predetermined time period to said date; and
said predetermined condition is satisfied when said refresh date is older than a current date.

42(new): The method of any one of claims 1, 33 and 34 further comprising:

determining, subsequent to said writing, a difference between a first value of the refresh indicator determined contemporaneous with said writing and a second value of the refresh indicator determined at a current time;

wherein said predetermined condition is satisfied when said difference is greater than a predetermined limit.

43(new): The method of any one of claims 1, 33 and 34 further comprising using an amplitude of a readback signal of the data as the refresh indicator.

44(new): The method of claim 43 wherein said amplitude is hereinafter “first amplitude” and the method further comprises:

writing the first amplitude to a location in the storage medium distinct from another location used to write the data;

measuring a second amplitude of the readback signal contemporaneous with said checking; and

said checking includes determining a difference between the second amplitude and the first amplitude.

45(new): The method of claim 44 wherein said checking further comprises comparing said difference with a predetermined limit.

46(new): The method of claim 45 wherein said checking further comprises comparing a percentage value of said difference with a predetermined percentage.

47(new): The method of claims 1, 33 and 34 wherein the checking is performed periodically without scanning the entire storage medium.

48(new): The method of claims 1, 33 and 34 wherein the refresh indicator is saved contemporaneous with said writing.

49(new): The method of claims 1, 33 and 34 wherein said “automatically reading the data” and said “writing the data a second time” are both performed periodically.

50(new): The method of claims 1, 33 and 34 wherein said “automatically reading the data” and said “writing the data a second time” are both performed on a schedule for all the data.

51(new): The method of claim 50 wherein said schedule is periodic.

52(new): A storage medium comprising a disk carrying data and having at least one property selected from a group of properties consisting of (a) spacing between adjacent magnetised locations of the magnetic disk less than 50 nm (b) recording density for the data greater than 500 kFCI (19685 kFCm) (c) grain diameter less than 100 Å and (d) energy ratio less than 50 KuV/KBT so as to cause spontaneous degradation over time; the disk further carrying a refresh indicator that indicates a predetermined condition related to degradation of the data over time.

53(new): The storage medium of claim 52 wherein:

the data is held on file; and

the refresh indicator is stored as an attribute of the file.

54(new): The storage medium of claim 52 or 53 wherein the attribute is stored in a directory entry of a file system.

55(new): The storage medium of claim 52 or 53 wherein the refresh indicator is based on a time when the data were most recently written.

56(new): The storage medium of any one of claims 52 and 53 wherein the refresh indicator is based on an amplitude of a readback signal of the data at the time of writing the data.

57(new): The storage medium of any one of claims 52 and 53 wherein the data is held as polarity of magnetized portion of the storage medium.

58(new): A carrier signal embedded with:

data wherein the spacing between adjacent magnetised locations of the medium is smaller than 50 nm and the recording density is greater than 500kFCI (19685 kFCm); and a refresh indicator that indicates a predetermined degradation of the data.

59(new): The carrier signal of claim 58 wherein the refresh indicator is based on a time when the data were most recently written.

60(new): The carrier signal of claim 58 wherein the refresh indicator is based on an amplitude of a readback signal of the data at the time of writing the data.

61(new): An apparatus including:

a storage medium embedded with data at a density sufficiently high to spontaneously undergo thermal degradation with passage of time wherein the spacing between adjacent magnetised locations of the medium is smaller than 50 nm and the recording density is greater than 500KFCI (19685 kFCm); and

an electronic device coupled to the storage medium to perform a refresh operation on the data when the data satisfy a predetermined condition related to the thermal degradation.

62(new): The apparatus of claim 61 wherein the predetermined condition is based on a time when the data were most recently written.

63(new): The apparatus of claim 61 wherein the predetermined condition is based on an amplitude of a readback signal of the data at the time of writing the data.

64(new): A storage medium embedded with computer instructions for:
writing data to a magnetic medium wherein the spacing between adjacent
magnetised locations of the medium is smaller than 50 nm and the recording density is
greater than 500kFCI (19685 kFCM); and
automatically reading the data and writing the data back to the magnetic medium
without scanning the magnetic medium.

65(new): The storage medium of claim 64 wherein:
during each writing the data are recorded at a density sufficiently high to
spontaneously undergo thermal degradation with passage of time; and
the computer instructions include checking if a refresh indicator satisfies a
predetermined condition related to degradation of the data over time.

66(new): A carrier signal embedded with computer instructions for:
writing data to a magnetic medium wherein the spacing between adjacent
magnetised locations of the medium is smaller than 50 nm and the recording density is
greater than 500kFCI (19685 kFCM); and
automatically reading the data and writing the data back to the magnetic medium
without scanning the magnetic medium.

67(new): The carrier signal of claim 66 wherein:
during each writing the data are recorded at a density sufficiently high to
spontaneously undergo thermal degradation with passage of time; and
the computer instructions include checking if a refresh indicator satisfies a
predetermined condition related to degradation of the data over time.

68(new): A method for storing information on a magnetic disk, the method
comprising:
writing the information to the magnetic disk, at least a portion of the
information being written to a group of grains in a track at a density sufficiently high to

cause a change in direction of magnetization of at least some of the grains with passage of a year; and

automatically refreshing at least the portion of information, using a refresh indicator.

69(new): The method of Claim 68 wherein:

 said portion of information comprises data; and
 another portion of information is critical information.

70(new): The method of Claim 68 wherein:

 the diameter of at least one grain in the group of grains is less than 100 angstroms.

71(new): The method of Claim 68 wherein:

 a transition in polarity between neighboring magnetized portions is less than a few grain diameters.

72(new): The method of Claim 68 wherein:

 an amplitude of a readback signal is used as the refresh indicator.

73(new): The method of Claim 72 wherein:

 said change in direction of magnetization results in loss of amplitude of said readback signal by 10 percent.

74(new): The method of Claim 72 wherein:

 said change in direction of magnetization results in loss of amplitude of said readback signal by 5 percent.

75(new): The method of Claim 68 wherein:

 said refresh indicator is related to a date of performance of said "writing the information to the magnetic disk".

76(new): The method of Claim 68 wherein:
said refresh indicator is saved contemporaneous with performance of said
"writing the information to the magnetic disk".

77(new): The method of Claim 68 wherein:
said refresh indicator indicates that the information in the magnetic disk contains
a soft error.

78(new): The method of Claim 68 wherein:
said refresh indicator satisfies a predetermined condition, indicating that the
information in the magnetic disk is about to contain at least one soft error.

79(new): The method of Claim 68 wherein:
said refresh indicator satisfies a predetermined condition, indicating that the
information in the magnetic disk is about to contain a predetermined number of soft
errors.

80(new): A method for storing information on a magnetic disk, the method
comprising:
writing the information to the magnetic disk, at least a portion of the information
being written to a group of grains in a track at a density sufficiently high to cause a
change in direction of magnetization of at least some of the grains with passage of a year;
and
automatically refreshing at least the portion of information, using at least two
refresh indicators.

81(new): The method of Claim 80 wherein:
at least one of the refresh indicators is related to an amplitude of a readback
signal.

82(new): The method of Claim 81 wherein:
the readback signal is stored on the magnetic disk at a lower density than another
portion of information on the magnetic disk.

83(new): The method of Claim 80 wherein:
at least one of the refresh indicators is related to a high-frequency component of a
readback signal.

84(new): The method of Claim 80 wherein:
at least one of the refresh indicators is related to a number of errors.